San Pasqual Fire
Burned Area Rehabilitation Plan

July 2016

U.S. Fish and Wildlife Service - Region 2
Bosque del Apache National Wildlife Refuge
San Antonio, New Mexico

San Pasqual Fire
BURNED AREA REHABILITATION PLAN
(22520-9262-KD4A)

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FIRE DATE: July 4, 2016
AGENCY/UNIT: Bosque del Apache National Wildlife Refuge,
P.O. Box 280, San Antonio, NM 87832
LOCATION/SIZE: Socorro County, New Mexico; Total Burned Area – 808 Acres
(808 Acres - FWS Lands); Treatment Area – 600 Acres

SUBMITTED BY: K. Cobble Date: 9/9/16
Kevin Cobble, Refuge Manager

Burned Area Rehabilitation Plan Review and Approval

I. Refuge Manager approval that the Burned Area Rehabilitation Plan meets approved land management plan objectives.

9/9/16

Kevin Cobble, Refuge Manager, Bosque del Apache National Wildlife Refuge — Date

II. Regional Fire Management Coordinator concurs that the plan fits the technical definition for use of Burned Area Rehabilitation funding.

9/13/16

Loren DeRosear, Regional Fire Management Coordinator, USFWS Region 2 — Date

III. Burned Area Rehabilitation Plan Approval (check one box below):

- ☐ Approved
- ☐ Approved with Revision (see attached)
- ☐ Disapproved

acting

9/20/16

Dr. Benjamin Tuggle, Regional Director, USFWS Region 2 — Date

IV. Burned Area Rehabilitation Plan Approval (for plans ≥ $500,000, check one box below):

- ☐ Approved
- ☐ Approved with Revision (see attached)
- ☐ Disapproved

Chris Wilcox, Chief, Branch of Fire Management, USFWS — Date

EXECUTIVE SUMMARY

This Burned Area Rehabilitation (BAR) Plan describes activities and treatments for lands and wildlife habitats impacted by the San Pasqual Fire. This plan encompasses US Fish and Wildlife Service (USFWS) lands within the San Pasqual Fire perimeter, including natural resources, trust resources, and wildlife habitat affected by the wildfire. This plan was prepared in accordance with the Department of Interior and U.S. Fish and Wildlife Service (FWS) policy, the Bosque del Apache NWR Habitat Management Plan, Floodplain Restoration Plan, and Draft Comprehensive Management Plan. This plan is in compliance with the National Environmental Policy Act (NEPA) (Appendix 1) and follows direction in the Department of Interior (DOI) Interagency Burned Area Emergency Response Guidebook (2006). Bosque del Apache NWR (Refuge hence forth) will be responsible for any additional compliance regulations required to implement this plan, including the NEPA, Federal Endangered Species Act, and the National Historic Preservation Act.

Crews responded to the San Pasqual Fire, on July 4th, 2016, southeast of the Refuge Headquarters (See Map 1). The fire was lightning caused. Due to the discontinuous nature of the Middle Rio Grande River (MRG) floodplain vegetation with meanders, wetlands, and backwaters; the fire-size estimate includes bodies of water and sand bars, where the fire did not spread. The fire was contained on July 10th and controlled on July 25th 2016 at 808 acres.

The initial Burned Area Rehabilitation (BAR) assessment was completed between July 13th and 27th, 2016. This region is undergoing a long-term severe drought, and therefore due to the pre-existing stress on native trees, even in areas with low fire severity we anticipate high rates of tree mortality. The fire burned wetland, riparian and upland vegetation composed of a mix of native and exotic species. The primary fire carrier included native grasses, shrubs and forbs, and exotic tamarisk (*Tamarix spp.*). The pre-existing heavy fuel loading in the mixed tamarisk stands interspersed with native mesquite, willow and cottonwood resulted in these sites being 'nuked' at the moderate and high burn severities.

Vegetation, site conditions, soils, water table depth, fire severity and effects will be used to establish and prioritize treatments on land forms that have higher probabilities for restoration success. Typically these sites have less-saline porous soils, pre-fire native vegetation assemblages, are in closer proximity to the water table, and in places are connected to the river through ephemeral overbank flooding. Strategic restoration efforts will be focused in these areas encompassing about 600 acres of the total 808 acres (See Maps 1 and 2). An existing riparian floodplain restoration plan and draft Environmental Assessment fortuitously covers this entire burned area, and it will provide the foundational plan to guide this project (USFWS 2005). The selected management areas will be further refined for treatments during site clearing and preparation, and through more detailed field evaluation of desirable site characteristics through a Strategic Habitat Management process.

Our primary rehabilitation goal will be to re-establish resilient native riparian, wetland, and flood plain habitats across this burned area. These habitats are increasingly rare while very productive. They support a great diversity of wildlife species and are essential for migratory waterfowl and migratory birds. This work will benefit the recovery of the Endangered southwestern willow flycatcher and New Mexico meadow jumping mouse, and the Threatened yellow billed cuckoo.

This rehabilitation effort will facilitate recovery of native habitats through integrated treatment of exotic tamarisk (e.g., mechanical and herbicide), while restoring willow and cottonwood via pole planting and natural seeding, and mesquite and other native shrubs via planting and natural seeding. Site preparation and treatment specifications will be tailored to utilize natural floodplain topographic features, to promote future wetland and overbank flooding, and to take advantage of the native seed cast timing during periods of seasonal flooding. The prescribed rehabilitation treatments are standard management practices used currently in the restoration program at the Refuge and also by the interagency community working in the greater Middle Rio Grande Valley. The demonstrated restoration capacity and success at Refuge NWR will greatly enhance the potential success of this project.

We anticipate potential in-kind funding from the Bureau of Reclamation, NM Water Trust Board, NM Game and Fish, Ted Turner's Armendaris Ranch, and the Friends of the Bosque del Apache NWR.

Sandhill cranes at the Refuge. CREDIT: Marvin DeJong

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PART A - FIRE LOCATION AND BACKGROUND INFORMATION

Fire Name	San Pasqual
Fire Number	22520-9262-D4AO
Agency Unit	Bosque del Apache National Wildlife Refuge
Region	USFWS Region 2
State	New Mexico
County(s)	Socorro
Ignition Date/Cause	7/4/2016 / Lightning
Date Fully Contained	7/10/2016
Total Acres	808 Acres
Refuge	808 Acres

PART B - NATURE OF PLAN

Type of Action (check one box below)

X	Initial Submission
	Amendment to the Initial Submission

PART C –REHABILITATION ASSESSMENT AND APPROACH

Fire Background

The fire burned primarily in tamarisk, with large stands of interspersed native shrub and native willow/cottonwood overstory vegetation on both sides of the river. The riparian shrubs including baccharis, coyote willows, and New Mexico olive which will likely resprout and respond favorably to post-fire conditions within 1-3 years. The tamarisk will also likely resprout vigorously and potentially invade new sites that prior to the fire were occupied by natives. Our primary concern is to rehabilitate and eventually restore the native stands of coyote willow, Goodding's willow, and cottonwood that will likely be significantly set back by the fire. These species and others make up diverse and essential riparian wildlife habitats for Threatened and Endangered Species along this stretch of the river. Sites prioritized for treatments will have environmental conditions with the greatest potential for restoration success. These sites will require additional evaluation (e.g., soil salinities, water quality, and depth to ground water) during site preparation to further refine suitable restoration areas and treatment regimes that have the highest probability for restoring resilient habitats.

Rehabilitation Plan Objectives:

- Cost-effective and ecologically-sound processes to restore wildlife habitat and to create ecological resilience at sites through the rehabilitation of native-dominated plant habitats, in accordance with approved land management plans and policies.

- Continue evaluation of site conditions and treatment effectiveness for rehabilitation treatment alternatives that are cost-efficient and that have a greater chance of success.

- Rehabilitate and restore native vegetation that is more suitable for wildlife, watershed and ecosystem function, and less-prone to future wildfire impacts.

- Decrease establishment and spread of exotic species, principally tamarisk in strategic locations, in order to reduce future wildfire size and threats to: Threatened and Endangered species and their habitats, important watershed and wildlife resources, and to adjacent wildlife habitat restoration efforts.

Resource Values at risk if rehabilitation is *not* funded and accomplished:

- **Threatened and Endangered Species and their habitats**; Resources at risk of further degradation include important wildlife habitats for several federally-listed species. The species are all known to occur within these marshlands and uplands of the burned area. Fire effects on soils and habitat degradation may likely impact these species.

  The **Rio Grande silvery minnow** is a federally-listed endangered species since 1994. This species lives in the Rio Grande which flows through the Refuge and San Pascual burned area.

  The **southwestern willow flycatcher** is a federally-listed endangered species (with critical habitat) since 1995. On the Refuge, nest locations have been located in both native and non-native vegetation. The majority of territories on the Rio Grande are found in native or native-dominated vegetation (BOR 2004).

  The **yellow-billed cuckoo** is a federally-listed threatened species (proposed critical habitat) since 2014. This species is common on the Refuge and occurs within the riparian forest patches of the active and historic floodplain within the Refuge. On the Refuge, they utilize areas of cottonwood over story and a dense under story of willows and baccharis. They migrate here in June then nest and breed on the Refuge and other areas throughout California, Arizona, New Mexico, and West Texas and then migrate south for winter in September.

  The **New Mexico meadow jumping mouse** is a federally-listed endangered species since July 10, 2014. Critical habitat was designated on March 16, 2016. On the Refuge, they utilize areas adjacent to managed wetlands, along ditches and drains that contain moist soils and dense herbaceous vegetation. The Refuge population is currently (2016) thought to be very low (<40 individuals), and occupies several small areas of the Refuge along the Riverside Canal. They historically occurred within riparian communities along rivers and streams, springs and wetlands, or canals and ditches characterized by one of two wetland vegetation community types: Persistent emergent herbaceous wetlands dominated by beaked sedge (*Carex rostrata*) or reed canarygrass (*Phalaris arundinacea*) alliances; or scrub-shrub riparian areas that are dominated by willows (*Salix* spp.) or alders (*Alnus* spp.).

- **One of the most biologically diverse and productive areas along the Middle Rio Grande:** The San Pasqual Fire occurred in one of the most biologically diverse portions of Refuge. The diversity and productivity of this area is largely attributed to the connectivity of the river with historic and restored sites across the Refuge landscape; that result in a mosaic of marshlands, wetlands, cottonwood/willow gallery forest, baccharis/NM olive woodlands, , and Chihuahua desert grasslands.

- **Native Habitats for Migratory Birds, Waterfowl, and other Wildlife Species**: Prior to the fire, willow/cottonwood riparian forest, baccharis/NM olive woodland and freshwater marshlands provided vegetation cover that served as habitat for many native wildlife species. Exotic tamarisk (*Tamarix sp.*) were also present in the burned area and at some sites, they were found in high densities providing the dominant vegetation cover. Tamarisk readily re-sprouts after fire and germinates profusely from seed on bare ground. It is highly likely tamarisk will invade new areas within the burned area unless there is an integrated approach to treat the resprouts and to re-establish native species in suitable habitats. Further invasion by these exotics will also increase the future fire hazard, decrease the biological diversity and native habitat sustainability, and increase the cost of restoring these sites in the future. To be clear, we are not proposing to treat or eradicate exotics everywhere within the burned area except at specific targeted restoration sites. The primary purpose at these sites will be to reduce competition with natives, and to create more desirable wildlife habitat that is less fire prone. The emerging tamarisk beetle biological control will likely compliment the rehabilitation treatments via defoliation of tamarisk, incidental tamarisk mortality, and enhanced native species vigor and competition.

- **Refuge**: The Refuge encompasses 57,331 acres located along the Rio Grande at the northern edge of the Chihuahuan Desert. It was established in 1939 to provide a critical stopover for waterfowl migrating along the Central North American Flyway. The Refuge is well known for the thousands of sandhill cranes, geese and other waterfowl that winter here each year. The Refuge encompasses the floodplain and the Middle Rio Grande River surrounded by agriculture fields and desert grasslands. Along this river channel, San Pasqual marsh and the surrounding wetlands and backwater areas provide important habitat for many wildlife. This Refuge attracts thousands of visitors annually to see the abundance of migratory waterfowl and birds that spend the fall and winter seasons at the Refuge. This BAR project will help the Refuge ensure that critical natural and Trust resources are maintained and restored after this fire.

Primary Refuge Planning Guidance for Burned Area Rehabilitation

The Refuge Draft Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) are in the final stages of the approval process (USFWS 2016a, In Progress). The CCP is designed to guide management of the Refuge for the next 15 years. The CCP provides a description of the desired future conditions and long-range guidance to accomplish the purposes for which the Refuge was established. The EA presents a range of alternatives for habitat and wildlife management, visitor services, and facilities management that consider issues and opportunities on the Refuge. It also identifies, describes, and compares the consequences of implementing management alternatives (including current management) on the physical, biological, and socioeconomic environment described in this CCP.

The CCP provides the following goals relevant to Burned Area Rehabilitation Planning:

- Contribute to conservation efforts and foster the ecological integrity of the Rio Grande watershed and Chihuahuan Desert through innovative management of the Refuge resources;

- Protect and enhance, through conservation, restoration, and management, wildlife habitat for native species and natural species diversity on the Refuge, including special status species, migratory waterbirds, neotropical migrants, and other resident wildlife;

- Provide Refuge visitors opportunities for safe, high quality, compatible, wildlife-dependent recreation such as environmental education, interpretation, wildlife observation and photography, hunting, and fishing, in order to promote understanding, appreciation and support for the Service's mission;

- Protect and preserve the Bosque del Apache Wilderness in an untrammeled, natural, undeveloped condition and provide solitude for primitive and unconfined recreation.

The Programmatic Environmental Assessment for the Control of Non-native Plant Species and Reestablishment of Native Riparian Forest, Wetlands, Grasslands, and In-channel Habitats on the Active Floodplain of the Rio Grande, will serve as an overarching guide for this project (USFWS 2016b, In Progress). The goals of this plan are;

- Improved biological diversity of the Rio Grande ecosystem and the restoration of river processes to support and maintain this diversity;

- Removal and control of non-native vegetation and the replacement of this vegetation with a "mosaic" of native dominated habitat areas including forest, wetland, grassland, shrublands and open river channel are described in detail in this planning document.

The USFWS New Mexico Fire District Spatial Fire Management Plan and Environmental Assessment were completed in 2012 (USFWS 2012) and support this BAR plan with the following goals and objectives:

Goals:

- Mechanical treatments are being used to remove undesirable fuel loading, reduce invasive plants, create and maintain fuel breaks, and create defensible space when it is not feasible to accomplish with the use of fire alone, due to the severity and inability to control such a fire, or because of constraints with protecting resources in the treatment area;

- Chemical treatments are being used to remove undesirable fuel loading, reduce invasive plants, create and maintain fuel breaks, and create defensible space when it is not feasible to accomplish

with the use of fire alone, due to the severity and inability to control such a fire or because of constraints with protecting resources in the treatment area.

Objectives:

- Protect life, property, human improvements, and cultural resources from the threat of wildfire through prevention, education, mitigation, and restoration actions on and adjacent to the six NWRs;

- Protect, restore, and maintain the ecological integrity of native biological communities by using prescribed fire (planned ignitions), wildfire (unplanned ignitions), and mechanical and chemical treatment methods to support a diversity of wildlife occurring on and near the six NWRs.

Burned Area Fire Effects Assessment

Of the 808 acre burned area, roughly 600 acres have been identified for treatments based on site conditions that indicate a higher probability for rehabilitation success. It is not feasible to conduct rehabilitation efforts throughout the burned area due to site conditions including high soil salinities, deep sandy soils, deeper ground water, and/or inability to access or control surface water.

Post-fire Vegetation, Potential Recovery, and Desired Conditions

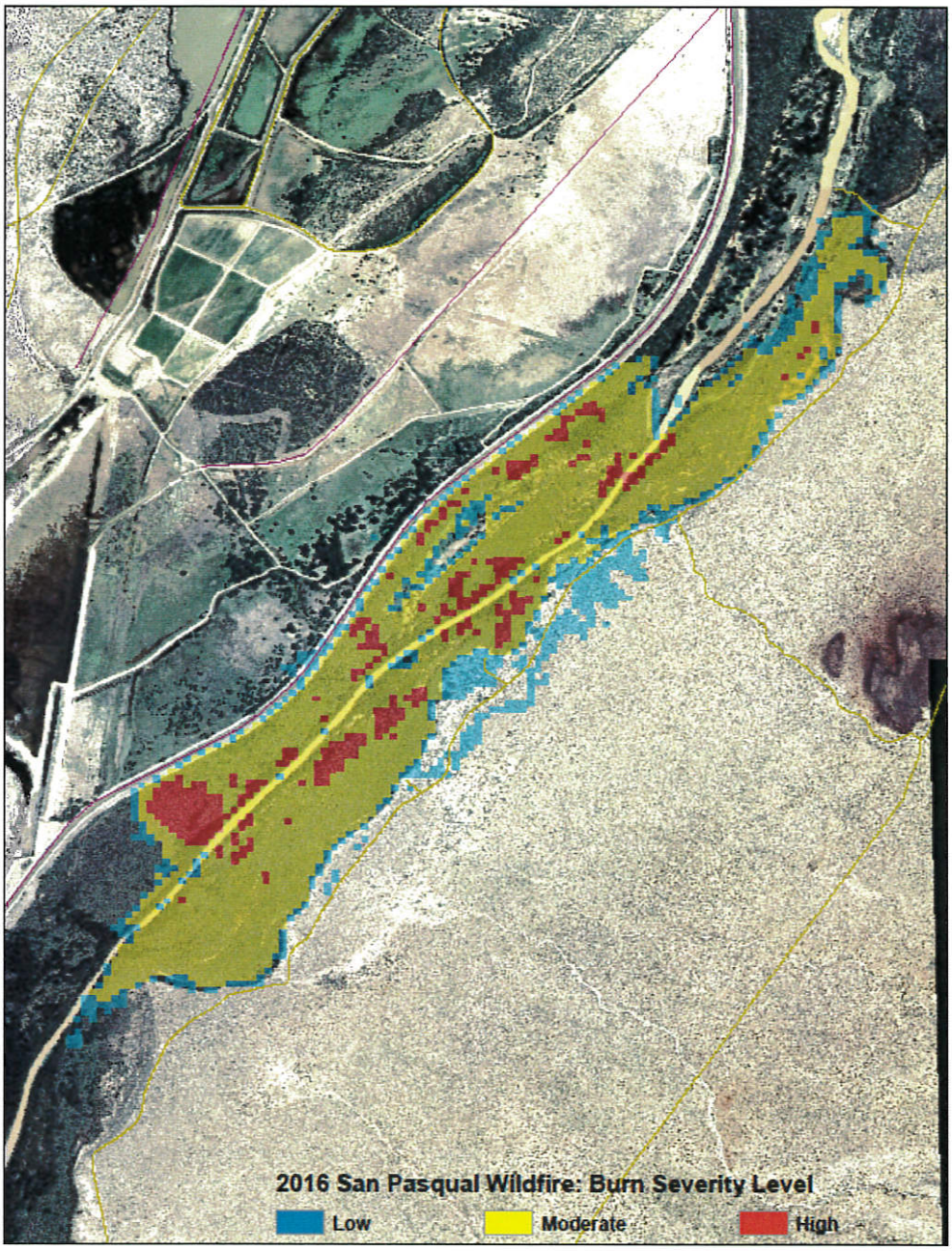
A burned area severity classification map was developed for the entire burned area. Map 2 below provides the severity classification image that provides an indication of burn severity and long-term potential for natural regeneration. Areas where a greater percentage of high and moderate burn severity suggests that vegetative reproductive resources and seed may be limited on these sites and vegetation recovery will likely require more time and possibly intervention by management. Due to the effects of the long-term drought on riparian tree species and their low tolerance of fire, even areas with low severity may experience high rates of tree mortality.

The adaptations and post-fire response of dominant vegetation species may be a valid consideration for evaluating site rehabilitation treatments. Dominant perennial species are described below.

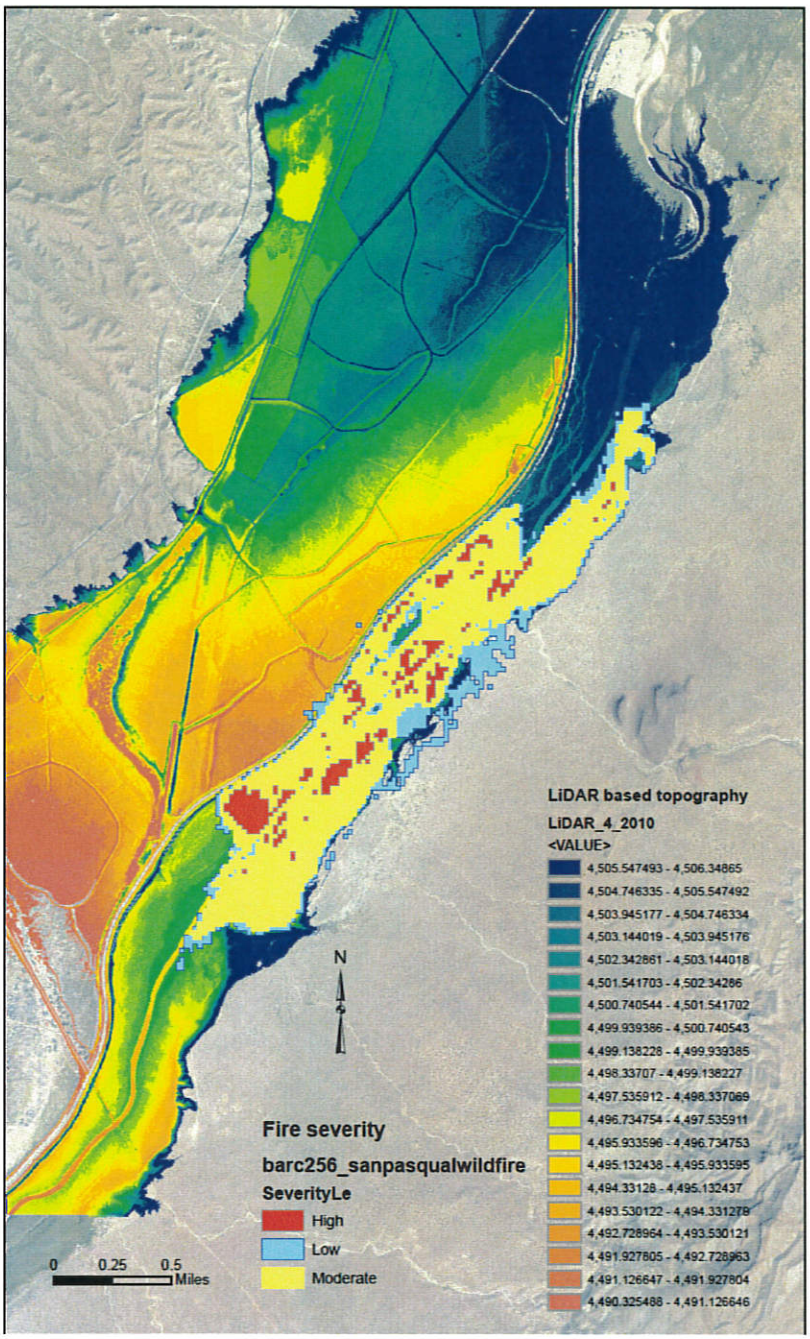
- Willow (*Salix exigua* and *Salix gooddingii*): Both coyote and Goodding's willow are highly desirable species for riparian bird habitat and frequently co-occur with cottonwood. Within the burned area, they typically occur along the floodplains, meanders and backwater swales along the river. Coyote willow is reportedly top-killed by fire. Fires that burn the upper layers of soil can destroy or expose roots and root crowns, resulting in willow mortality. As an example, when top-killed by low- to moderate-severity fire, narrowleaf willow resprouts vigorously from roots, root crowns, and basal stems. More sprouts are produced after quick, intense fires than after slower fires, which are potentially more damaging to narrowleaf willow and result in few, if any,

sprouts (Anderson 2006). Information concerning effects of fire and fire response for Goodding's willow is lacking, but is likely to be similar to that described for other willows (Reed 1993), including coyote willows. Willows can also reproduce by seed under similar conditions to those described below for cottonwood. Likewise, both species of willow are readily re-established on suitable sites via the pole planting method described for cottonwood.

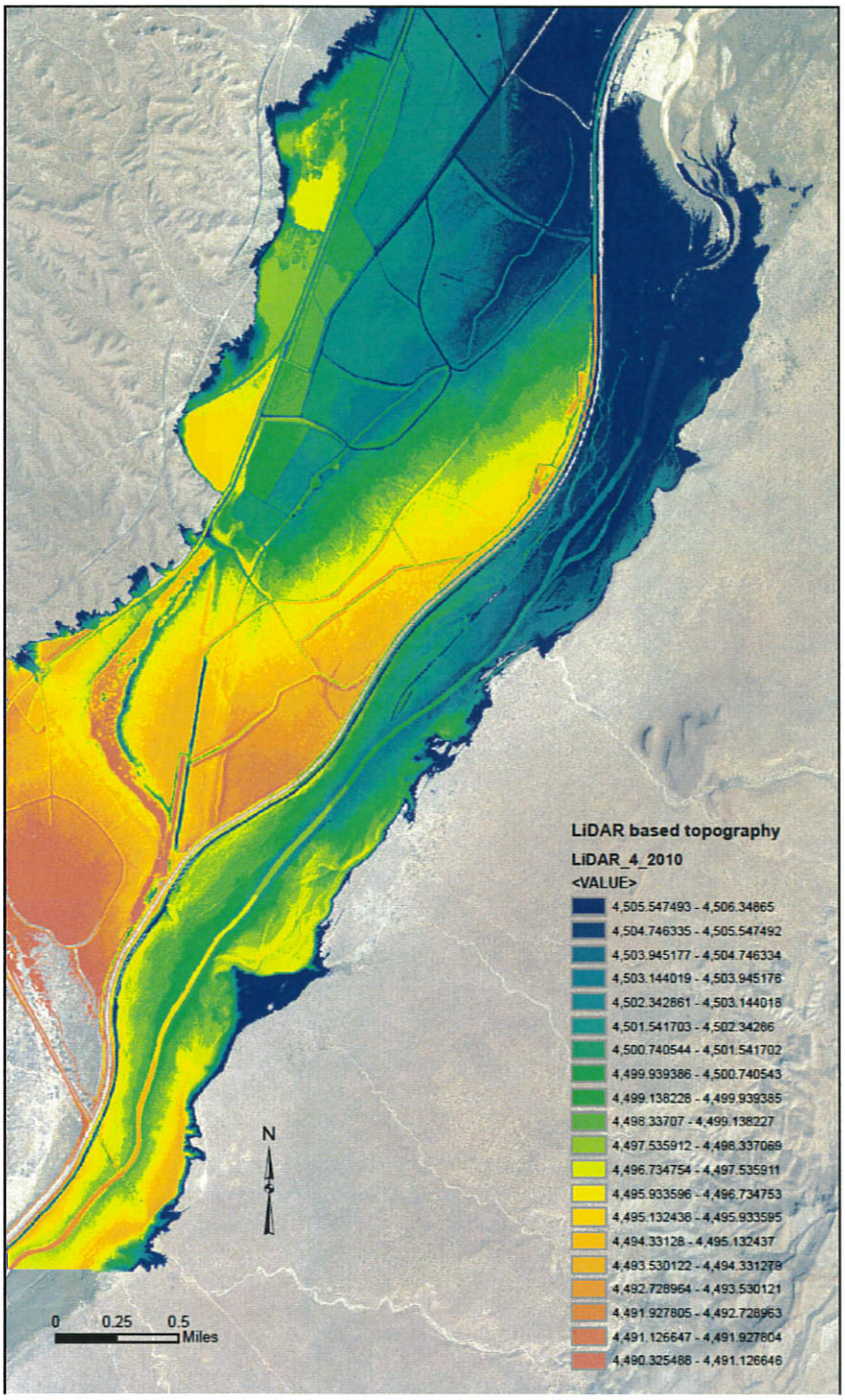
- Cottonwood (*Populus deltoides ssp wizlizeni*): Cottonwood is a highly desirable species for riparian bird habitat, and typically occurs along the river meanders where episodic flooding occurs and/or where the soil to ground-water depth is shallow (e.g., ≤ 3-10 feet). Cottonwood is susceptible to top-kill in fires, but often suffers little root crown or root damage in fast moving fires or where soil burn severity is low to moderate. Cottonwood is reportedly top killed by damage to the cambium layer from even low severity fire (Taylor 2000), though mature canopy trees that initially appeared too scorched for survival after fire have also been observed to eventually recover even up to 5 years later (S. Dingman NPS, pers. obs). Cottonwood sprouts readily and vigorously after fire or other injury, primary from stumps and root crowns but also from root suckering (Taylor 2000) and has been observed to re-sprout within one month of a fire (S.Dingman, pers. obs, Piute Fire, California 2004-2011). Cottonwood also reproduces by seed, though the precise timing of seed rain on moist mineral soil in spring is necessary (Taylor 2000). The timing of the San Pasqual Fire may provide some potential for seeding, although limited, due to the fewer number of cottonwoods available as seed sources and that the majority of flowering has already occurred this year. Subsequent early season floods could provide the proper soil conditions for seed germination and success. Seed viability is relatively short-lived on the order of 1-5 weeks after dispersal with germination typically occurring within 24 to 48 hours on suitable seedbeds (Taylor 2000). Cottonwood is readily established on suitable sites via pole planting, generally involving the cutting of poles (< 4m) of various diameters (2-10 cm) and either laying them laterally in moist soil conditions or inserting them vertically into moist soil during later winter season.



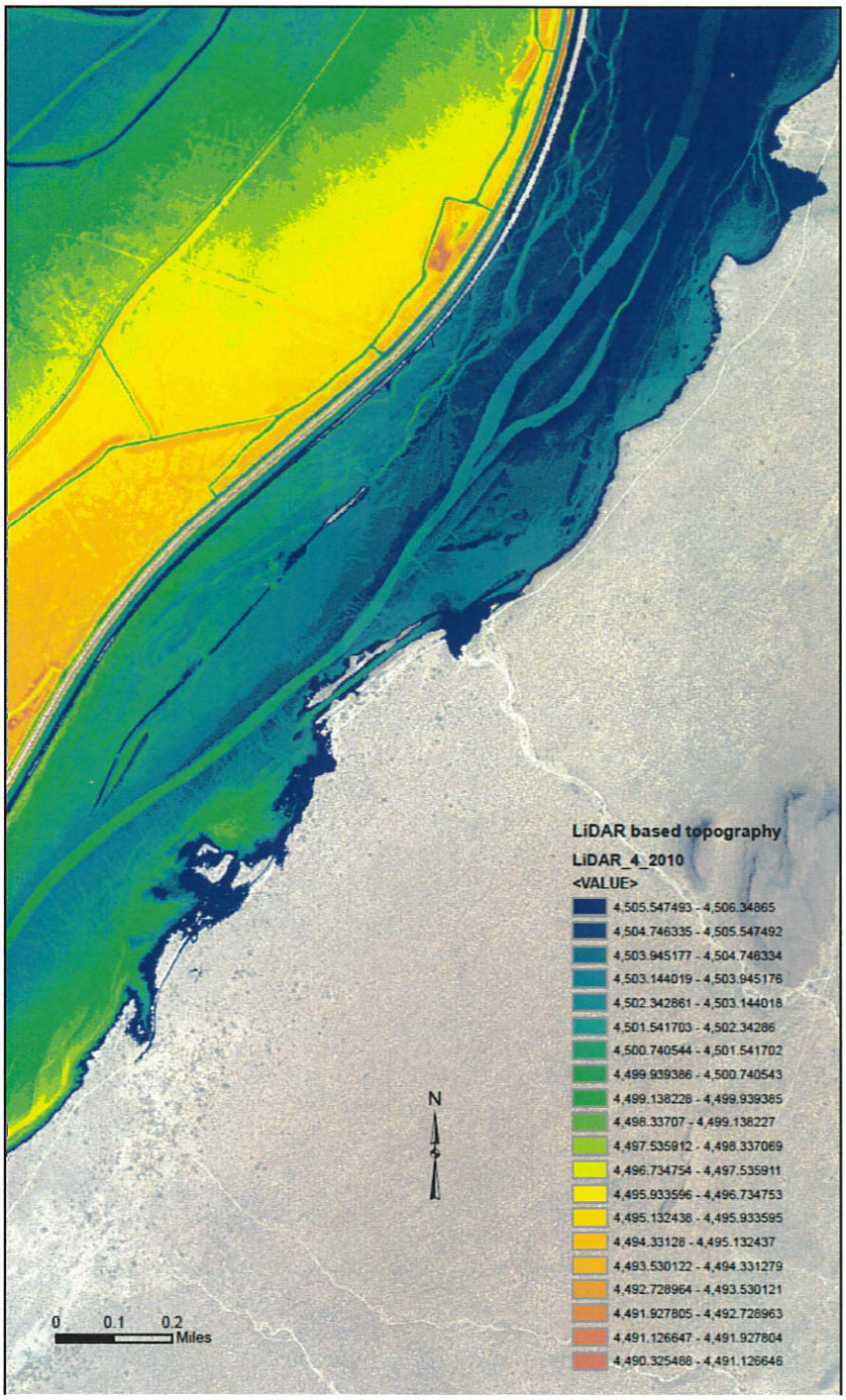
Map 1. Burned Area Reflectance Severity Classification Map showing medium, mixed, and high burn severity classes



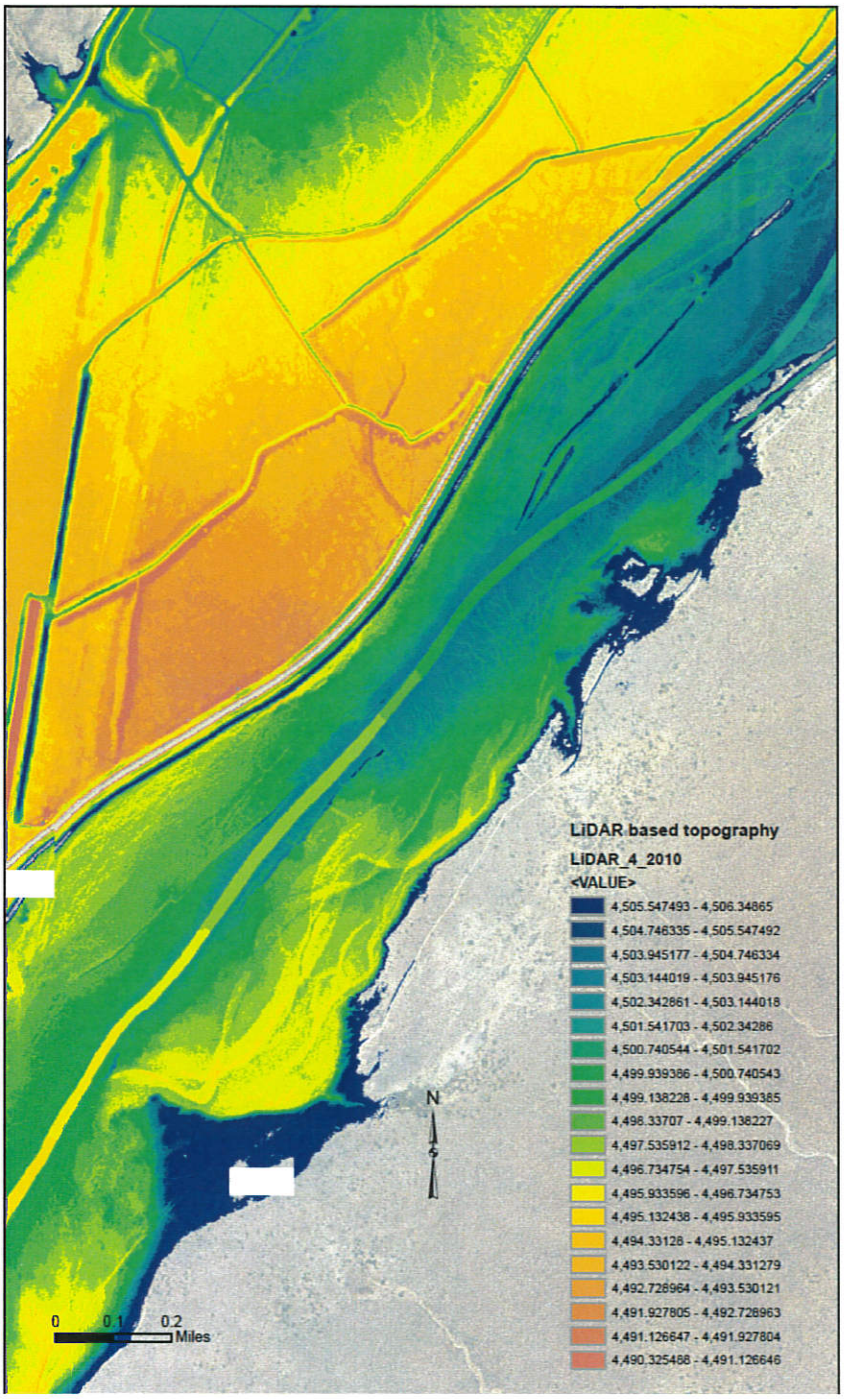
Map 2. LiDAR topographic map of burned area with Burned Area Severity Classification overlayed.



Map 3. LiDAR topographic map of burned area landscape.



Map 4. LiDAR topographic map of burned area landscape North.



Map 5. Lidar topographic map of burned area landscape South.

- Baccharis/NM olive/screwbean mesquite (*Prosopis pubescens, Baccharis sp. and Foresteria neomexicana*): Baccharis is reported to re-sprout post-fire from crown buds, root crown, and root buds (Meyer 2005b), thus shrubs that were subjected to relatively light intensity fire may re-sprout with the onset of winter moisture. NM olive monitored after past fires on the Refuge has shown successful re-sprouting (BdA unpublished information). Following the San Pedro Fire in 1996, baccharis and NM olive resprouted and survived to establishment (G. Dello Russo, pers. comm, 9/8/16). It is anticipated that much of this zone will likely re-colonize with native species including those above and screwbean mesquite on the floodplain, and other species such as honey mesquite (*Prosopis glandulosa*) in the upland areas where present from existing seed sources if water is applied either through rainfall or targeted localized irrigation.

- See Appendix 2 below for more detailed information on major plant species fire adaptations and ecology including tamarisk.

Post-fire Vegetation Challenges

The hydrologic stability introduced into the Middle Rio Grande River by dams and channelization caused the replacement of the diverse vegetative communities by aggressive non-native species that formed large stands of monotypic communities, primarily tamarisk. As a result, soil salinities in some areas are high and unsuitable for native species. High salinity interferes with plant water uptake which results in water-stress and eventually mortality. Some plant species however have adapted strategies to avoid or tolerate the physiological stress of high salinity and are called halophytes. Soil salinity exhibits variability concentrations temporally and spatially due to fluctuations in water table, surface flow variation, topography, and other site specific characteristics. See Table 1 below for ranked reported salinity tolerance and thresholds for native woody plants proposed for use in restoration (adapted from Parametrix Cibola Revegetation Plan).

Species	**Tolerance** [1]	**Threshold**[2]
Salix gooddingii Goodding's willow	Low	3 dS/m
Salix exigua coyote willow	Low	3 dS/m
Populus fremontii Fremont cottonwood	Low	3 dS/m
Prosopus pubescens screwbean mesquite	Moderate	8 dS/m
Prosopus gladulosa honey mesquite	Moderate	8 dS/m
Atriplex lentiformis quailbush	High	up to 60 dS/m
Pluchea sericea arrowweed	High	up to 120 dS/m

Table 1. Soil Salinity Tolerance of Selected Plant Species.

[1] source: USDA Plants Database which defines salinity classes as none/non-saline is less than 2 dS/m; low/slightly/weakly saline is 2 to 4 dS/m; medium/moderately saline is 4 to 8 dS/m; high/very saline is 8 to 16 dS/m; and extremely saline is greater than 16 dS/m.[2] source: Anderson et al. 2004.

Desired Conditions

In the long run the Refuge will maintain and monitor this project similar to other restoration projects on their property. General monitoring such as photo points and transects will be established during the rehabilitation phase to determine the response to techniques to restore native vegetation. These stations will be sustained for long term monitoring as well. The site will also be incorporated into the overall vegetation monitoring, sensitive species monitoring, and hydro-geomorphic monitoring that is accomplished periodically. The Refuge will respond to the observance of invasive species and habitat decline with a review of conditions and trends and develop an adaptive approach to addressing what is observed. The Refuge will implement work to address given conditions. Again, the overall goals of the project are to replace invasive tamarisk and other nonnative plants with a mosaic of native plant communities adapted to the area which will provide greater biological diversity and reduce the likelihood of future catastrophic fires in the area.

REHABILITATION APPROACH

Rehabilitation treatments will be focused within the active floodplain using topographic features along with soil conditions, and past and potential vegetation assemblages to guide specific site treatment regimes. The strategy will be to prepare and enhance rehabilitation site conditions, to rehabilitate native riparian and wetland habitats, and to facilitate natural recovery where feasible. The primary treatments will likely include;

- Site preparation (e.g., clearing site of course woody debris, soil grading, and root plowing);
- Successive herbicide treatments to control tamarisk throughout the implementation of the plan;
- Cottonwood and willow pole planting (e.g., Goodding's willow and coyote willow);
- Native shrub and grasses plantings and seeding depending on site conditions;
- Natural overbank and controlled flooding (e.g., portable pumps) may be utilized where topographic and edaphic conditions support and to take advantage of natural seed cast.

These treatments are similar to those regularly employed by the Refuge restoration program (Taylor et al 1999 & 2006, Dello Russo 2013), used on other fires that have occurred in the region including the Refuge Marcial BAR project, and similar projects on the Middle Rio Grande (TetraTech 2004). Treatment regimes will be adapted to reflect unique site conditions and lessons learned during the project implementation.

All sites will also serve as native-species 'resource islands' that will provide future native seed sources for dispersal, create habitat patches less prone to fire, and eventually enhance biological diversity and ecological resilience across the greater landscape. The "resource islands" concept is an arid-land restoration technique. A description of this technique and theory is briefly described in this excerpt from Abella et al. 2012.

The concept of fertile island as a means of native plant restoration is a common practice in the desert restoration. Fertile islands are areas of ameliorated environmental conditions. They are small areas within a larger landscape in which restoration (planting, seeding, mulching, etc.) occurs. These islands then serve as a source population for the larger area either through granivores or wind dispersal. Early successional seeds and late successional plants are often part of the matrix.

While plant size often determines competitive ability in more mesic ecosystems, other traits such as canopy architecture, timing of germination, and soil modification related to fertile islands (resulting in facilitation rather than competition) may be more important in deserts.

Therefore, earlier successional communities that potentially create a higher, less patchy cover may indeed be more effective in limiting exotic species establishment through competitive effects, whereas late-successional scrub communities provide little competitive effect in interspaces (a majority of the space) and facilitative effects within fertile islands beneath shrubs (Rodríguez-Buriticá & Miriti 2009).

DESCRIPTION OF REHABILITATION TREATMENT REGIMES

Tamarisk Control using Herbicide Treatments

Integrated and aggressive tamarisk control will include mechanical, herbicide, and biological-control treatments for at least the 3 year duration of the project. The mechanical and herbicide treatments are pretty standard and will require more intensive management on years 1 and 2 and declining in intensity and cost in later years. The tamarisk leaf beetle introduced in the region in 2014 and to the Middle Rio Grande of New Mexico in the last 8 yearsresults in tamarisk defoliation, and although not controlled will likely compliment other management treatments through increased tamarisk stress and reduced seed production (Ben Bloodworth pers. comm. 9/8/16), reduced competitive strength, and increased vigor for adjacent native species. Area to be treated approximately 600 acres.

Foliar application on resprouts and/or new germination use triclopyr ester (Garlon IV Ultra or equivalent) at 20% concentration with vegetable oil adjuvant in a low volume basal spray to treat tamarisk when sprouts are 3-6 feet tall applying herbicide to lower 12-18" of sprout. Application should be done in winter months when the daytime high temperatures are forecasted below 80 degrees F but above 50 degrees F. Applications of triclopyr ester (Garlon IV) should cease once the temperature reaches 80 degrees due to the potential for volatilization which creates a gaseous cloud of herbicide that can drift and cause non-target damage and reduce the effectiveness of the treatment on tamarisk. Application should be by backpack sprayer. Alternatively other herbicides may be considered on a site-specific basis. Also new germination (up to 24 inches tall) can be hand pulled in moist soil conditions but care must be taken to remove the tap root.

On live trees use a cut-stump application of 10% imazapyr (Habitat or equivalent) with a nonionic surfactant at a rate of 0.25 v/v (or 1 qt /100gal) or other herbicide labeled for this application. Cut stump involves cutting down the tree with a chainsaw and immediately applying herbicide to the remaining stump so that it can be translocated to the root system.

Cottonwood/Willow Pole Planting
Regenerate willow/cottonwood stands to maintain high value habitat for Threatened and Endangered birds and other species. The sites will be located in natural or constructed depressions or swales; topographic features where cottonwood and willow species existed prior to fire and were overbank flooding, soil conditions and water table will enhance success. The target future desired condition will be multi-aged and multi-sized stands of cottonwood, willow species, and native shrub and grass understory vegetation in various densities. Area proposed approximately 400 acres.

The pre-fire, site specific vegetation conditions include areas that generally support mature cottonwood, Goodding's willow, coyote willow, baccharis, NM olive, and interspersed with tamarisk, cattail and other emergent marshland vegetation with intermittent flooding and shallow water table (e.g., 3-8 ft). Some willow and cottonwood trees will likely re-sprout after fire and some of the trees that are only lightly scorched are expected to survive. Due to the pre fire presence of tamarisk and proximity to both surface and ground water, some of these sites have high susceptibility to tamarisk invasion and will require herbicide treatments throughout life of project.

Cottonwood/Willow Year 1
- Prepare and excavate site to remove fire impacted vegetation and coarse woody debris for site access, safety, and for revegetation.
- Tamarisk resprouts herbicide control using appropriate methods for cut-stump or foliar application.
- Willow/cottonwood pole planting (coppice stock cut at least 1 week prior to planting and root ends soaked in water during this time before planting) Jan – Feb.
- Plant native seed and shrubs to enhance site diversity.
- Flood irrigate where appropriate.
- Monitor treatment effectiveness

Cottonwood/Willow Year 2
- Prepare and excavate new sites to remove fire killed vegetation and coarse woody debris for site access, safety, and to prepare for revegetation.
- Return to sites from Year 1 to continue rehabilitation treatments where needed.
- Tamarisk resprouts herbicide control using appropriate methods for cut-stump or foliar application.

- Willow/cottonwood pole planting (coppice stock cut at least 1 week prior to planting and root ends soaked in water during this time before planting) Jan – Feb.
- Plant native seed and shrubs to enhance site diversity.
- Flood irrigate where appropriate.
- Monitor treatment effectiveness

Cottonwood/Willow Year 3

- Prepare and excavate any remaining sites to remove fire killed vegetation and coarse woody debris for site access, safety, and to prepare for revegetation.
- Return to sites from Years 1 and 2 to continue rehabilitation treatments where needed.
- Tamarisk resprouts herbicide control using appropriate methods for cut-stump or foliar application.
- Willow/cottonwood pole planting (coppice stock cut at least 1 week prior to planting and root ends soaked in water during this time before planting) Jan – Feb.
- Plant native seed and shrubs to enhance site diversity.
- Flood irrigate where appropriate.
- Monitor treatment effectiveness

Shrub Mixed

Re-establish coyote willow, baccharis, NM olive, screwbean and honey mesquite throughout more arid sites. Locate sites that were dominated by native shrub species prior to fire totaling approximately 100 acres. The target condition for this treatment is native baccharis/NM olive understory in cottonwood/willow forest to support listed species, shrub patches of coyote willow along the edge of cottonwood/willows for listed species, woodlands with either a grassy understory (e.g. mesquite savannah) or with an understory of other native shrub and berry-producing species.

Native shrub sites of various ages and densities were interspersed throughout the burned area. Most of these sites experienced low and moderate soil burn severity as shown on Map 1. It is uncertain how the scorch and under burn will affect post-fire response, but generally the shrubs are expected to recover in places through re-sprout and seed germination. To enhance germination of in-situ seedbeds, flood irrigation in late spring/early summer may be conducted. In places of higher burn severity, the seedbed could have been consumed by fire and may need active restoration using seeds from other localities and/or use of deep-potted plants. As observed on other Refuge projects, native grasslands and perennial shrubs are expected to readily re-colonize these sites.

Shrub Mix -Year 1

- Prepare and excavate site only in places where necessary to remove fire impacted vegetation and coarse woody debris for site access, safety, and to prepare for revegetation.
- Tamarisk herbicide control using selective chemical methods for cut-stump or foliar application.

- Collect local shrub seed in May/June/July, have scarified if needed, and disperse on site prior to monsoon season and flood irrigation.
- Rake/seed shurb sites to create fertile islands in areas where natural germination is unsuccessful.
- Plant native shrubs to enhance site diversity.
- Flood at natural seed germination times consistent with monsoon activity.
- Monitor treatment effectiveness.

Shrub Mix - Year 2

- Prepare and excavate new sites only in places where necessary to remove fire killed vegetation and coarse woody debris for site access, safety, and to prepare for revegetation.
- Return to sites from Year 1 to continue rehabilitation treatments where needed.
- Tamarisk herbicide control using selective chemical methods for cut-stump or foliar application.
- Collect local shrub seed in May/June/July, have scarified if needed, and disperse on site prior to monsoon season and flood irrigation.
- Rake/seed shrub sites to create fertile islands in areas where natural germination is unsuccessful.
- Plant native shrubs to enhance site diversity.
- Flood irrigate at natural seed germination times consistent with monsoon activity.
- Monitor treatment effectiveness.

Shrub Mix - Year 3

- Prepare and excavate site only in places where necessary to remove fire killed vegetation and coarse woody debris for site access, safety, and to prepare for revegetation.
- Return to sites from Years 1 and 2 to continue rehabilitation treatments where needed.
- Tamarisk herbicide control using selective chemical methods for cut-stump or foliar application.
- Collect local shrub seed in May/June/July, have scarified if needed, and disperse on site prior to monsoon season and flood irrigation.
- Rake/seed shrub sites to create fertile islands in areas where natural germination is unsuccessful.
- Willow and cottonwood pole planting as appropriate/needed on the wetland edges and patches.
- Flood irrigate at natural seed germination times consistent with monsoon activity.
- Monitor treatment effectiveness.

Willow Swales

Re-establish willow swales on bottomland wetland sites where coyote existed prior to the fire on approximately 100 acres. These sites have the shallowest water tables (e.g., 0-3 ft) and greatest connectivity to the main river channel which provides intermittent overbank flows and flooding to help maintain. Once planted these sites should become self-sustaining and only require limited future spot herbicide treatments.

Willow Swales - Year 1

- Excavate site and soils to remove fire killed vegetation and coarse woody debris and to ensure water table to soil depth adequate for willow pole planting.
- Tamarisk herbicide control using selective chemical methods for cut-stump or foliar application and considering aquatic herbicide label if in proximity to open water and appropriate.
- Use dozer to rake or furrow site to prepare for willow pole plantings, seeding, and deep-potted plants.
- Revegetate site with high-density of willow pole plantings, shrubs, seeding, and deep-potted plants.

Willow Swales - Year 2

- Excavate new sites and soils to remove fire killed vegetation and coarse woody debris and to ensure water table to soil depth adequate for willow pole planting.
- Tamarisk herbicide control using selective chemical methods for cut-stump or foliar application and considering aquatic herbicide label if in proximity to open water and appropriate.
- Use dozer to rake or furrow site to prepare for willow pole plantings, seeding, and deep-potted plants.
- Revegetate site with high-density of willow pole plantings, shrubs, seeding, and deep-potted plants.

Willow Swales - Year 3

- Excavate new sites and soils to remove fire killed vegetation and coarse woody debris and to ensure water table to soil depth adequate for willow pole planting.
- Tamarisk herbicide control using selective chemical methods for cut-stump or foliar application and considering aquatic herbicide label if in proximity to open water and appropriate.
- Use dozer to rake or furrow site to prepare for willow pole plantings, seeding, and deep-potted plants.
- Revegetate site with high-density of willow pole plantings, shrubs, seeding, and deep-potted plants.

PART D - TEAM MEMBERS AND RESOURCE ADVISORS

I. Burned Area Emergency Response assistance, review and comment on draft documents:
This burned area rehabilitation plan was prepared by Mark Kaib, USFWS Region 2, Deputy Regional Fire Management Coordinator, USFWS.

Consultation and input were provided by;
Gina Dello Russo, Retired Ecologist, BDA NWR USFWS
Kevin Cobble, Refuge Manager, BDA NWR USFWS
Bernard Lujan, Deputy Refuge Manager, BDA NWR USFWS
Jeff Sanchez, Supervisory Refuge Biologist, BDA NWR USFWS
Eric Krueger, Fire Management Officer, BDA NWR USFWS
Paul Tashjian, Hydrologist, NWRS, R2 Division of Hydrology, USFWS
Lou Ballard, National BAER Coordinator, USFWS

PART E - SUMMARY OF ACTIVITIES AND COSTS

REHABILITATION ACTIVITIES COST SUMMARY TABLE - San Pasqual Fire

SPECIFICATION NUMBER	TITLE	UNIT	UNIT COST	NUMBER OF UNITS	WORK AGENT	COSTS
1	BAR Implementation Leader	NA	NA	0	C/S	$ 150,000
2	Environmental Compliance and Effectiveness Monitoring	NA	NA	0	F, C, S, V	$ 45,000
3	Cottonwood/Willow	acres	$1,500	400	C, S, V, F	$ 451,400
4	Shrub Mix	acres	$1,000	100	C, S, V, F	$ 94,800
5	Willow Swales	acres	$2,000	100	C, S, V, F	$ 79,500
6	Administrative/Budget Support	N/A	N/A	0	F	$ 35,000
					TOTAL COSTS	$ 855,700

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

FUNDING NEEDED BY FISCAL YEAR – San Pasqual Fire

Spec #	Specification Title	FY 17	FY18	FY19	Total Cost
1	BAR Implementation Leader	$50,000	$50,000	$50,000	$150,000
2	Environmental Compliance and Effectiveness Monitoring	$15,000	$15,000	$15,000	$45,000
3	Cottonwood /Willow	$216,000	$141,600	$93,800	$451,400
4	Shrub Mix	$23,000	$64,000	$7,000	$94,800
5	Willow Swales	$9,000	$63,500	$7,000	$79,500
6	Administrative/Budget Support	$12,500	$13,500	$9,000	$35,000
	Totals	$325,500	$347,600	$181,800	$855,700

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	BAR Implementation Leader	**PART E SPECIFICATION #**	1
NFPORS TREATMENT CATEGORY*		**FISCAL YEAR(S) (list each year):**	FY17, FY18, FY19
NFPORS TREATMENT TYPE *		**WUI? Y / N**	
IMPACTED COMMUNITIES AT RISK		**IMPACTED T&E SPECIES**	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:
A. General Description: The BAR Implementation Leader will coordinate and oversee the quality control of the entire project in collaboration with the Refuge Biologist. On the ground project work includes herbicide treatments, restoration pole-palnting, revegetation, and seeding treatments, and all site preparation work necessary to implement the treatments and activities proposed in this BAR Plan. Any additional costs for this position will be obtained through inkind funding potentially through identified partners.
B. Location/(Suitable Sites): Duty station at BDA NWR
C. Design/Construction Specifications: The BAR Implementation Leader should be hired as soon as possible. Ideally this person should have a background and interest in biological sciences and riparian restoration.
D. Position will provide oversight for Treatment Effectiveness Monitoring.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	**COST / ITEM**
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	**COST / ITEM**
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL MATERIALS AND SUPPLY COST	
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	**COST / ITEM**
Implementation Leader; Seasonal, Term or Student Intern Position, 6-9 months	$ 50,000
Implementation Leader; Seasonal, Term or Student Intern Position, 6-9 months	$ 50,000
Implementation Leader; Seasonal, Term or Student Intern Position, 6-9 months	$ 50,000
TOTAL AGREEMENT/CONTRACT COST	$ 150,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISH MENTS	PLANNED COST
FY 17	10/01/16	09/30/17	C, S	NA	ea	NA	$ 50,000
FY 18	10/01/17	09/30/18	C, S	NA	ea	NA	$ 50,000
FY 19	10/01/18	05/29/19	C, S	NA	ea	NA	$ 50,000
					TOTAL	**0**	**$ 150,000**

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFWS	NA	$ 150,000
	TOTAL COST	**$ 150,000**

Specification Form Created September 23, 2006

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Environmental Compliance and Effectiveness Monitoring	PART E SPECIFICATION #	2
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY17, FY18, FY19
NFPORS TREATMENT TYPE *		WUI? Y / N	
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description: This activity will accomplish the environmental compliance documentation and consultations as needed to implement approved restoration treatments. Treatment efefctiveness monitoring will also be covered under this specification primarily in years 2 and 3.

B. Location/(Suitable Sites): Not Applicable.

C. Design/Construction Specifications:All consultation work should occur early in Year 1 prior to the initiation of the other treatments. Service may be provided by either agency personnel at the Refuge, Complex, or Regional Office. Prepare documented categorical exclusions for the National Environmental Policy Act as provided for in agency policy.Work with the Zone Biologist for the Southwest Arizona Refuge Complex to initiate informal consultation (for listed species) and conference (for candidate species) with US Fish and Wildlife Service's Ecological Services Office in Phoenix, AZ in compliance with Section 7 of the Endangered Species Act. Complete any biological assessments and/or field surveys as may be required by the consultation process.Work with the Regional Archaeologist to complete compliance documentation for cultural resources and, if required, consultation with the State Historic Preservation Officer as provided for in Section 106 of the National Historic Preservation Act and agency policy.

D. Purpose of Treatment Specifications: To complete the necessary environmental compliance procedures for the implementation of the approved treatments to restore native riparian woodland habitat.

E. Treatment Effectiveness Monitoring Proposed: Qualitatively assess relative effectiveness of herbicide, pole planting, pot planting, and seeding treatments. In year one photo points and monoitoring protocols established, with increasing monitoring in years 2 and 3.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-12/4 Enviromental Consulting Specialist (or equivalent) 2 pp x $5,000/pp in FY17	$ 10,000
GS-7 Biologist (or Equivalent) ≥ 3 pp x $1,500/pp in FY17	$ 5,000
GS-7 Biologist (or Equivalent) 10 pp x $1,500/pp in FY18	$ 15,000
GS-7 Biologist (or Equivalent) 10 pp x $1,500/pp in FY19	$ 15,000
TOTAL PERSONNEL SERVICE COST	$ 45,000
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	**COST / ITEM**
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL MATERIALS AND SUPPLY COST	#REF!
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY17	10/01/16	06/04/17	FA, C	acres		600	$15,000
FY18	10/01/17	06/04/18	FA, C	acres		600	$15,000
FY19	10/01/18	06/04/19	FA, C	acres		600	$15,000
				TOTAL		1800	**$45,000**

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFWS	NA	$ 45,000
	TOTAL COST	**$ 45,000**

Specification Form Created September 23, 2006

TREATMENT/ACTIVITY NAME	Cottonwood /Willow	**PART E SPECIFICATION #**	3
NFPORS TREATMENT CATEGORY*		**FISCAL YEAR(S) (list each year):**	FY17, FY18, FY19
NFPORS TREATMENT TYPE *		**WUI? Y / N**	
IMPACTED COMMUNITIES AT RISK		**IMPACTED T&E SPECIES**	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of w ork to be done):

Number and Describe Each Task:

A. General Description: Rehabilitation Crew may be Student Conservation, State Correctional, or other similar contract workforce. Mechanically prepare site for access and safety through limited clearing of tamarisk and integrated herbicide treatments combined with cottonwood/willow plantings to include pole planting, potted plans, and seeding where appropriate, and utilize overbank flooding or portable pump flooding to facilitate natural recovery. Augment farm field cottonwood and willow vegetative stock for pole plantings in year 2 and 3.

B. See supporting rehabilitation umit maps, totaling approximately 400 acres.

C. Design/Construction Specifications:The target condition is multi-age/size stands of cottonwood and willow species.

D. Purpose of Treatment Specifications: Regenerate cottonwood/willow stands to maintain high value habitat for endangered riparian birds and other species

E. Treatment Effectiveness Monitoring Proposed: See Specification #2.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	**COST / ITEM**
Excavator Operator Wage Grade 10 @ $30/hour X 800 hours in FY17	$24,000
Excavator Operator Wage Grade 10 @ $30/hour X 320 hours in FY18	$9,600
Excavator Operator Wage Grade 10 @ $30/hour X 160 hours in FY19	$4,800
TOTAL PERSONNEL SERVICE COST	**$ 38,400**
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	**COST / ITEM**
Excavator w/ Thumb Reimbursment Cost to Refuge $9,000/month for 5 months in FY17	$45,000
Excavator w/ Thumb Reimbursment Cost to Refuge $9,000/month for 2 months in FY18	$27,000
Excavator w/ Thumb Reimbursment Cost to Refuge $9,000/month for 1 month in FY19	$18,000
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	**$ 90,000**
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	**COST / ITEM**
herbicide, adjuvents, and PPE = $19,000 in FY17	$ 19,000
herbicide, adjuvents, and PPE = $9,000 in FY18	$ 9,000
herbicide, adjuvents, and PPE = $7,000 in FY19	$ 7,000
TOTAL MATERIALS AND SUPPLY COST	**$ 35,000**
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	**COST / ITEM**
Rehabilitation/ Invasive Species Crew (crew of 5-7 @ $8,0000/week for 16 weeks in FY17)	$128,000.00
Rehabilitation/ Invasive Species Crew(crew of 5-7 @ $8,0000/week for 12 weeks in FY18)	$96,000.00
Rehabilitation/ Invasive Species Crew (crew of 5-7 @ $8,0000/week for 8 weeks in FY19)	$64,000.00
	$ 288,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISH MENTS	PLANNED COST
FY 17	10/01/16	09/30/17	C, S, FA	acres	$ 540	400	$ 216,000
FY 18	10/01/17	09/30/18	C, S, FA	acres	$ 354	400	$ 141,600
FY 19	10/01/18	05/29/19	C, S, FA	acres	$ 235	400	$ 93,800
				TOTAL		**1200**	**$ 451,400**

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	M, P
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

See treatment Prescriptions and Supporting Maps

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFWS	1200	$ 451,400
	TOTAL COST	**$ 451,400**

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Shrub Mix	**PART E SPECIFICATION #**	4
NFPORS TREATMENT CATEGORY*		**FISCAL YEAR(S) (list each year):**	FY17, FY18, FY19
NFPORS TREATMENT TYPE *		**WUI? Y / N**	
IMPACTED COMMUNITIES AT RISK		**IMPACTED T&E SPECIES**	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description: Rehabilitation Crew may be Student Conservation, State Correctional, or other similar contract workforce. Mechanically prepare site for access and safety through limited clearing of tamarisk and integrated herbicide treatments combined with mesquite and other native shrub plantings, to include bare root planting, deep potted plans, and seeding where appropriate. Collect native seeds on Refuge lands where available.

B. See supporting rehabilitation umit maps, totaling approximately 100 acres.

C. Design/Construction Specifications:The target condition is multi-age/size stands of mesquite and native shrub species.

D. Purpose of Treatment Specifications: Regenerate mesquite and native shrub patches in more arid sites to maintain high value habitat for endangered riparian birds and other species

E. Treatment Effectiveness Monitoring Proposed: See Specification #2.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	**COST / ITEM**
Excavator Operator Wage Grade 10 @ $30/hour X 160 hours in FY18	$ 4,800
TOTAL PERSONNEL SERVICE COST	$ 4,800
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	**COST / ITEM**
Excavator w/ Thumb Reimbursment Cost to Refuge $9,000/month for 1 month in FY18	9000
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	$ 9,000
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	**COST / ITEM**
herbicide, adjuvents, and PPE = $9000 in FY17	$ 9,000
herbicide, adjuvents, and PPE = $2000 in FY18	$ 2,000
TOTAL MATERIALS AND SUPPLY COST	$ 11,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	**COST / ITEM**
Rehabilitation/ Invasive Species Crew (crew of 5-7 @ $7,0000/week 2 weeks in FY17)	$14,000.00
Rehabilitation/ Invasive Species Crew (crew of 5-7 @ $7,0000/week 7 weeks in FY18)	$49,000.00
Rehabilitation/ Invasive Species Crew (crew of 5-7 @ $7,0000/week 1 weeks in FY19)	$7,000.00
	$ 70,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 17	10/01/16	09/30/17	C, S, FA	acres	$ 230	100	$ 23,000
FY 18	10/01/17	09/30/18	C, S, FA	acres	$ 648	100	$ 64,800
FY 19	10/01/18	05/29/19	C, S, FA	acres	$ 70	100	$7,000.00
				TOTAL		**300**	**$ 94,800**

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	M, P
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

See treatment Prescriptions and Supporting Maps

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFWS	300	$ 94,800
	TOTAL COST	**$ 94,800**

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Willow swales	**PART E SPECIFICATION #**	5
NFPORS TREATMENT CATEGORY*		**FISCAL YEAR(S) (list each year):**	FY17, FY18, FY19
NFPORS TREATMENT TYPE *		**WUI? Y / N**	
IMPACTED COMMUNITIES AT RISK		**IMPACTED T&E SPECIES**	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description: Rehabilitation Crew may be Student Conservation, State Correctional, or other similar contract workforce. Mechanically prepare site for access and safety through limited clearing of tamarisk and integrated herbicide treatments combined with cottonwood/willow/mesqute plantings facilitated also with natural recovery to include pole planting, potted plans, and seeding where appropriate. Expand farm field cottonwood and willow pole vegetative stock for plantings in year 2 and 3.

B. See supporting rehabilitation umit maps, totaling approximately 75 acres.

C. Design/Construction Specifications:The target condition is multi-age/size stands of cottonwood, willow, and mesquite species.

D. Purpose of Treatment Specifications: Regenerate cottonwood/willow meanders and mesquite patches in more arid sites to maintain high value habitat for endangered riparian birds and other species

E. Treatment Effectiveness Monitoring Proposed: See Specification #2.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	**COST / ITEM**
Excavator Operator Wage Grade 10 @ $30/hour X 400 hours in FY18	$ 12,000
TOTAL PERSONNEL SERVICE COST	$ 12,000
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	**COST / ITEM**
Excavator w/ Thumb Reimbursment Cost to Refuge $9,000/month for 2.5 months in FY18	$22,500
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	**COST / ITEM**
herbicide, adjuvents, and PPE = $2000 in FY17	$ 2,000
herbicide, adjuvents, and PPE = $1000 in FY18	$ 1,000
TOTAL MATERIALS AND SUPPLY COST	$ 3,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	**COST / ITEM**
Rehabilitation Crew (crew of 5-7 @ $7,0000/week 1 week in FY17)	$7,000.00
Rehabilitation Crew (crew of 5-7 @ $7,0000/week 4 weeks in FY18)	$28,000.00
Rehabilitation Crew (crew of 5-7 @ $7,0000/week 1 weeks in FY19)	$7,000.00
	$ 42,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 17	10/01/16	09/30/17	C, S, FA	acres	$ 90	100	$9,000
FY 18	10/01/17	09/30/18	C, S, FA	acres	$ 635	100	$63,500.00
FY 19	10/01/18	05/29/19	C, S, FA	acres	$ 70	100	$7,000.00
				TOTAL		300	**$79,500**

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	M, P
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

See treatment Prescriptions and Supporting Maps

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFWS	75	$ 79,500
	TOTAL COST	**$ 79,500**

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Administrative/Budget Support	**PART E SPECIFICATION #**	6
NFPORS TREATMENT CATEGORY*		**FISCAL YEAR(S) (list each year):**	FY17, FY18, FY19
NFPORS TREATMENT TYPE *		**WUI? Y / N**	
IMPACTED COMMUNITIES AT RISK		**IMPACTED T&E SPECIES**	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description: This budget overhead chage (<10%) will be used to cover Regional Office, Refuge Complex, and/or National Office overhead, budget, finance, FBMS, reporting, and planning support.

B. Location/(Suitable Sites): Not Applicable.

C. Design/Construction Specifications: Not Applicable.

D. Purpose of Treatment Specifications: Not Applicable.

E. Treatment Effectiveness Monitoring Proposed: Not Applicable.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	**COST / ITEM**
RO Administrative/Budget Support- Various Grades	$ 35,800
TOTAL PERSONNEL SERVICE COST	$ 35,800
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	**COST / ITEM**
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL MATERIALS AND SUPPLY COST	$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	**COST / ITEM**
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY17	10/01/16	09/30/17	FA	N/A	N/A	NA	$ 12,500
FY18	10/01/17	09/30/18	FA	N/A	N/A	NA	$ 13,400
FY19	10/01/18	06/04/19	FA	N/A	N/A	NA	$ 9,900
					TOTAL	**0**	**$ 35,800**

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFWS	NA	$ 35,800
	TOTAL COST	**$ 35,800**

Specification Form Created September 23, 2006

PART G - RESTORATION REQUIREMENT

The following are post-rehabilitation implementation, operation, maintenance, monitoring, and evaluation actions beyond three years from fire control to ensure the effectiveness of initial investments

1. Continue tamarisk herbicide treatments as necessary.
2. Consider additional plantings if needed to meet desirable habitat conditions.
3. Maintain recreational facilities.
4. Conduct hazardous fuels reduction activities to reduce the spread of future wildland fires.

APPENDIX I - SUPPORTING DOCUMENTS

A. References

Abella, Scott R., Donovan J. Craig, Stanley D. Smith, and Alice C. Newton. In review. Identifying Native Vegetation for Reducing Exotic Species during the Restoration of Desert Ecosystems.

Anderson, Michelle. 2006. *Salix exigua* [coyote willow]. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2011, September 9].

Dello Russo, Gina. 2013. Tamarisk management at Bosque del Apache National Wildlife Refuge: a resource manager's perspective. In: Tamarisk: a case study of ecological change in the American west. Oxford University Press 488 p.

Department of Interior (DOI) Interagency Burned Area Emergency Response Guidebook (2006 - www.fws.gov/fire/ifcc/esr/Policy/BAR_Guidebook11-06.pdf).

DOI Departmental Manual - DM - 613 (1984) Lower Colorado Land Use Program.

FEIS – USDA Forest Service - Fire Effects Information System (http://www.fs.fed.us/database/feis/).

Meyer, Rachelle. 2005a. *Atriplex lentiformis* [quailbush]. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed September 9, 2011].

Meyer, Rachelle. 2005b. *Prosopis pubescens* [screwbean mesquite]. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed September 9, 2011].

Parametrix, Inc. September 2008. Cibola Fire Revegetation Plan (Review Draft). 61 pp.

Reed, William R. 1993. *Salix gooddingii* [Gooddings willow]. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2011, September 9].

Steinberg, Peter. 2001. *Prosopis glandulosa* [honey mesquite]. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed September 9, 2011].

Taylor, Jennifer L. 2000. *Populus fremontii* [Fremont cottonwood]. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2011, September 9].

Taylor, John P., D.B.Wester, and L.M. Smith. 1999. Soil disturbance, flood management, and riparian woody plant establishment in the Rio Grande floodplain. Wetlands 19(2):372-382.

Taylor, John P., L.M. Smith, and D.M. Haukos. 2006. Evaluation of woody plant restoration in the Middle Rio Grande: Ten years after. Wetlands 26(4):1151-1160.

U.S. Fish and Wildlife Service. 2012. New Mexico Fire District Spatial Fire Management Plan and Environmental Assessment.

U.S. Fish and Wildlife Service. 2016a. In progress. Bosque del Apache NWR Draft Comprehensive Conservation Plan/ Environmental Assessment.

U.S. Fish and Wildlife Service. 2016b. In Progress. Final Plan and Draft EA; Control of Non-native Plant Species and Reestablishment of Native Riparian Forest, Wetlands, Grasslands and In-channel Habitats on the Active Floodplain of the Rio Grande, Bosque del Apache NWR.

Zouhar, Kris (2003, April). *Tamarix* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed September 9, 2011].

Labor Sources and Partnerships:

There are current agreements in place to provide access to labor and funding from several sources, including:

- New Mexico State Lands Environmental Department and Bureau of Prison – This partnership provides the resource management expertise of the New Mexico State Lands Department and the physical labor of inmate crews under the direction of the New Mexico Department of Corrections to supply labor crews for a variety of wildland firefighting related duties.

- Southwest Conservation Corps – As a part of AmeriCorps, this program provides labor crews and crew leaders for a variety of tasks in wildland settings. These crews have been used successfully for saw work, site prep, and planting on other NWRs.

- Student Conservation Association –This partnership program provides interns for a variety of resource management tasks. This program has been used for invasive species work as part of the Invasive Species Strike Team for the Refuge Complex.

- ACE - American Conservation Experience in Flagstaff Arizona specializes in providing youth work crews on many types of diverse work projects. ACE crews are heavily involved with the National Park Service and the USFWS AZ Invasive Species Strike Team, and are currently involved with fire rehabilitation projects and invasive species control on National Wildlife Refuges.

- USFWS Invasive Species Strike Team –This program provides invasive species eradication/control on national wildlife refuges with a focus on EDRR (early detection, rapid response). Crews have been dedicated to NWRs in New Mexico for the past few years for specific projects identified by refuge personnel.

ENVIRONMENTAL COMPLIANCE for US Fish and Wildlife Service Actions:

Federal, State, and Private Lands Environmental Compliance Responsibilities

All projects proposed in the San Pasqual Fire Rehabilitation Plan that are prescribed, funded, or implemented by Federal agencies on Federal, State, or private lands are subject to compliance with the National Environmental Policy Act (NEPA) in accordance with the guidelines provided by the Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508); Department of the Interior and U.S. Fish and Wildlife Service. This Appendix documents the Burned Area Emergency Response team and Refuge considerations of NEPA compliance requirements for prescribed rehabilitation and monitoring actions described in this plan for all jurisdictions affected by the San Pasqual Fire.

Related Plans and Cumulative Impact Analysis

San Pasqual Fire Burned Area Rehabilitation Plan (4/2016). The San Pasqual Fire Rehabilitation Plan was reviewed and it was determined that actions proposed are consistent with the management objectives established in the LCR NWRs Comprehensive Management Plan. The Comprehensive Management Plan NEPA compliance process (Environmental Assessment) specifically addresses:

- Biological Resources
- Air Quality
- Water Quality
- Wetland Preservation and Enhancement
- Compatibility and Service Policy on Recreational Uses
- Cultural Resources
- Socioeconomics

Cumulative Impact Analysis

Cumulative effects are the environmental impacts resulting from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions, both Federal and non-Federal. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. The rehabilitation treatments for areas affected by the San Pasqual Fire, as proposed in the plan, do not result in an intensity of impact (i.e. major ground disturbance, etc.) that would cumulatively constitute a significant impact on the quality of the environment. The treatments are consistent with the above jurisdictional management plans and associated environmental compliance documents and categorical exclusions listed below.

Applicable and Relevant Categorical Exclusions

The individual actions proposed in this plan for the San Pasqual Fire burned area are Categorically Excluded from further environmental analysis as provided for in the Department of Interior and U.S. Fish and Wildlife Service Categorical Exclusions. All applicable and relevant Department and Agency Categorical Exclusions are listed below. Categorical Exclusion decisions were made with consideration given to the results of required emergency consultations completed by the burned area emergency response team and documented below.

Applicable Department of Interior Categorical Exclusions

516 DM 2 App; 2, 1.6
516 DM 6 App. 7.4 L (3)

Applicable U.S. Fish and Wildlife Service Categorical Exclusions

516 DM 6 App. 1.4 B (1)
516 DM 6 App. 1.4 B (3) iii
516 DM 6 App. 1.4 B (5)

Statement of Compliance for the San Pasqual Fire Burned Area Rehabilitation Plan.

This section documents consideration given to the requirements of specific environmental laws in the development of this plan. Specific consultations initiated or completed during development and implementation of this plan are also documented. The following executive orders and legislative acts have been reviewed as they apply to the San Pasqual Fire Burned Area Rehabilitation Plan:

- National Historic Preservation Art (NAPA).
- Executive Order ll988. Flood plain Management.
- Executive Order 11990. Protection of Wetlands.
- Executive Order 12372. Intergovernmental Review.
- Executive Order 12892. Federal Actions to Address Environmental Justice in Minority and Low-income Populations.
- Endangered Species Act.
- Secretarial Order 3127. Federal Contaminated
- Clean Water Act.
- Clean Air Act.

CONSULTATIONS

Intra-Agency Section 7 Consultation initiated regarding any potential effects to T&E species.
NEPA Checklist: If any of the following exception applies, the Rehabilitation Plan cannot be Categorically Excluded and an Environmental Assessment (EA) is required.

(Yes)	(No)	
( )	(X)	Adversely affect Public Health and Safety
( )	(X)	Adversely affect historic or cultural resources, wilderness, wild and scenic rivers aquifers, prime farmlands, wetlands, floodplains, ecologically critical areas, or Natural Landmarks.
( )	(X)	Have highly controversial environmental effects.
( )	(X)	Have highly uncertain environmental effects or involve unique or unknown environmental risks.
( )	(X)	Establish a precedent resulting in significant environmental effects.
( )	(X)	Relates to other actions with individually insignificant but cumulatively significant environmental effects.
( )	(X)	Adversely effects properties listed or eligible for listing in the National Register of Historic Places
( )	(X)	Adversely affect a species listed or proposed to be listed as Threatened or Endangered.
( )	(X)	Threaten to violate any laws or requirements imposed for the "protection of the environment" such as Executive Order 1 1 988 (Floodplain Management) or Executive Order 1 1 990 (Protection of Wetlands).

National Historic Preservation Act

Ground Disturbance:

( ) None
(X) Minimal ground disturbance may occur at rehabilitation sites in unconsolidated flood plains. Agency archeologists will be consulted, and if appropriate a survey will be conducted, as required under section 110 of the NHPA will be prepared. A report will be prepared under contract as specified by the Rehabilitation Plan.

A NHPA Clearance Form:

( ) Is required because the project may have affected a site that is eligible or on the national register. The clearance form is attached. SHPO has been consulted under Section 106 (see Cultural Resource Assessment, Appendix I).

(X) Is not required because the Rehabilitation Plan has no potential to affect cultural resources (initial of cultural resource specialist).

Other Requirements

(Yes) (No)

( ) (X) Does the Rehabilitation Plan have potential to affect any Native American uses? If so, consultation with affiliated tribes is needed.

(X) ( ) Are any toxic chemicals, including pesticides or treated wood, proposed for use? If so, local agency integrated pest management specialists must be consulted.

I have reviewed the proposals in the San Pasqual Fire Burned Area Rehabilitation Plan in accordance with the criteria above and have determined that the proposed actions would not involve any significant environmental effect. Therefore it is categorically excluded from further environmental (NEPA) review and documentation. We have completed necessary coordination and consultation to insure compliance with the National Historic Preservation Act, Endangered Species Act, Clean Water Act and other Federal, State and local environment review requirements.

9/9/16

Jeff Sanchez, Refuge Biologist — Date

9/9/16

Kevin Cobble, Refuge Manager — Date

Appendix II

Discussion of fire effects and adaptations

The following fire adaptation and ecology references are taken from the Fire Effects Information System (See FEIS website for more information on numbered references by species; http://www.firelab.org/science-applications/fire-ecology/155-feis).

Mesquite
When the aboveground portion of honey mesquite is damage by fire, regeneration occurs by sprouting from lateral roots in the upper 1 foot (0.3 m) of soil and establishing from seed [81]. Mature plants contain numerous, dormant buds on the upper 12 inches (30 cm) of the taproots [47,62,64] where they are insulated from the heat of most fires. Following top-kill by fire, numerous sprouts arise from the underground buds. Even 6- month- old seedlings have sufficiently developed underground stem buds to allow plants to survive "cool" burns [190]. The data of Ansley and others [10] suggest that bark on older stems is often thick enough to protect the phloem from damage; when top-kill does occur, it is more commonly via damage at canopy height. Mortality is low in honey mesquite, particularly in lowland areas where root systems are well developed [188,190]. In riparian communities of the Colorado River, however, where western honey mesquite grows with tamarisk, frequent fire will likely lead to a decline of western honey mesquite and increase of tamarisk because the latter grows much faster [4,126].

The response of honey mesquite following fire depends on the amount of damage the fire inflicted on the plant. Plants may initiate new growth from either buds within the crown or from underground buds on the taproot or lateral roots [73] following fire. Following low-severity fires which only partially top-kill plants, mesquites often sprout from axillary buds on branches [41]. In a low fuel load (1160 lbs/ac) fire near Encinal, Texas honey mesquite had recovered to 106% of preburn canopy cover in 2 years, but still had 14% less canopy cover than honey mesquite in the unburned control plot [78]. Following fires that result in complete top-kill, plants may survive by producing numerous basal stem sprouts, by establishing from seed, or by sprouting from lateral roots or the upper part of the taproot [47,62,64].

Tamarisk
Tamarisk is usually top-killed by fire, and severe fire may kill the entire plant [80,90,116]. Tamarisk seeds withstand a dry heat of 212 degrees Fahrenheit (100 °C) for 20 minutes; higher temperatures kill seeds within a few minutes [120]. The immediate effect of fire on tamarisk depends on fire severity, which is largely a function of the quantity and quality of fuels present. Tamarisk leaves are not highly flammable due to high moisture content, even though they contain volatile oils. Tamarisk flammability increases with the build-up of dead and senescent woody material within the plant [43,185]. When plants burn under conditions of high fuel loads, fire tends to be more severe, top-killing many plants and increasing the likelihood of complete mortality in some individuals (e.g., [80,90,116]).

In experimental burns in tamarisk in eastern New Mexico, plots burned 5 years before did not carry treatment fires as well as plots that were previously unburned [116,185]. Postfire canopy reduction on previously unburned sites ranges from 60 to 90%, while sites that were reburned after 5 years had 30 to 60% canopy reduction after burning. Areas where fire was reapplied after 5 years had variable tamarisk mortality, up to 31% [116].

Tamarisk plants can sprout following top-kill from fire [35,80,90,107,178,211,214,220]. The source of the sprouts is not usually described, although 2 accounts specify sprouting from the root crown [178,211], one says that tamarisk is "a vigorous root sprouter following fire" [35], and another notes that tamarisk "regrew rapidly from rootsprouts" [214] after wildfire. After a wildfire in a Rio Grande riparian forest, Ellis [80] found that "root suckering was nearly absent" in tamarisk but that 53% to 55% of tamarisk individuals sprouted from existing root crowns. Sala [197] noted that "underground lateral roots" are actually rhizomes in tamarisk. If that is the case, tamarisk likely sprouts from rhizomes after fire.

Canopy cover of tamarisk can increase after fire, as observed by Busch [43] along the lower Colorado River floodplain. A canopy fire at Lees Ferry, Arizona, killed 10% of mature tamarisk plants, and surviving plants produced shoots that exceeded 6 feet (1.8 m) in height within 5 months [220]. Similarly, regrowth of surviving tamarisk plants after a July wildfire at Lake Meredith National Recreation Area, Texas, exceeded 6 feet (1.8 m) at the end of that growing season [90].

Flowering in tamarisk may increase after fire. Stress-induced flowering was observed in tamarisk at Lees Ferry in August following a canopy fire. Significantly fewer ($p<0.001$) unburned tamarisk plants were blooming (10.9% of 101 plants on adjacent, unburned control areas), while 69.4% of 144 burned plants were blooming heavily [220].

Tamarisk response to fire depends on timing of the fire (temperature and moisture conditions and phenological stage of tamarisk), fire severity, and postfire plant competition [116,185]. Timing of fire can affect tamarisk response due to its effects on fire severity, subsequent climatic conditions, or susceptible phenological stage. Observations by Horton [121] suggest that under stressed conditions, as many as half of the tamarisk shrubs on a site may not survive burning [121]. Ongoing research in eastern New Mexico is being conducted to determine the best phenological stage to burn and reburn tamarisk to reduce density, canopy, and hazardous fuel load. Phenological stages at which treatments have been applied include: dormancy, leaf elongation, first bloom, full canopy, and leaf senescence [116]. A review by Grace and others [101] suggests that burning during the peak of summer has the strongest adverse effect on tamarisk, presumably due to ensuing water stress. Tamarisk mortality exceeded 60% 12 months following a July wildfire at Lake Meredith National Recreation Area, Texas [90].

Fire severity can affect how many plants in a stand are top-killed and how many suffer complete mortality. Severe fires kill all aboveground portions of trees, but may result in extensive and rapid growth from the root crown in tamarisk [178]. After fire in a riparian forest along the Rio Grande River in New Mexico, no tamarisk retained viable aboveground tissue and root suckers (suckers not within 30

cm of an existing stem) were nearly absent. Sprouting of tamarisk from existing root crowns (shoot suckers, within 30 cm of an existing stem) occurred in 53% of individuals at high severity (no leaf litter remaining in reference areas) burn sites and in 55% of individuals at low- (leaf litter burned in patches, not entirely consumed) and mixed-severity burn sites [80]. At Afton Canyon in southern California, fire mortality of tamarisk following prescribed fire appeared to be low within "high intensity" burn areas (around 10 to 25%), and no mortality was observed in "low and medium intensity" burn areas [155].

Plant community composition can affect the response of tamarisk to fire. On floodplains in Nepal, *T. dioica* is replaced by other taxa following fire [72], but a review by Busch [43] suggests that recently burned marshes in the Near East are frequently colonized by halophytes including *T. passerinoides*. In riparian areas in southwestern North America, tamarisk typically occurs with various species of cottonwood, willow and mesquite. Because postfire resprouting can be vigorous in many of these woody taxa, prefire vegetation is an important determinant of postfire community structure.

Cottonwood/Willow

While willow and cottonwood species are able to resprout following disturbances such as fire (see FEIS summaries of individual species for more information), tamarisk may be better adapted to the postfire environment than native riparian species [44].

After fire on the lower Colorado River floodplain, tamarisk dominated in all community types, while cottonwood was nearly absent from all burned plots [43]. Tamarisk invasion along the Arkansas River floodplain may have been facilitated by an increase in frequency of wildfires fueled by dense stands of tamarisk. These fires damaged or killed many cottonwoods while tamarisk "regrew rapidly from rootsprouts" [214]. Greater water use efficiency and higher hydraulic efficiency in burned tamarisk relative to Goodding willow and Fremont cottonwood may also facilitate the recovery of tamarisk following fire in low-elevation riparian habitats of the Southwest [43,44].

Short-term responses of riparian vegetation to a wildfire was monitored at 2 study sites at the Bosque del Apache National Wildlife Refuge in the Rio Grande Valley in New Mexico [80]. Fire severity reflected the amount of organic debris present before the fire, which reflected flooding history at the 2 sites: fire severity was lower at the site with a more extensive flooding history and less debris. Resprouting was prevalent among cottonwoods at both burn sites including basal stem sprouts, root-crown sprouts, and root suckering. However, of the native Rio Grande cottonwoods in the area, only those located in an area that experienced lower fire severity (had been regularly flooded) retained viable aboveground tissue 2 years after the fire [80]. Considering the fuel accumulations along the Middle Rio Grande Valley [81], it is likely that fire severity will continue to be high and the loss of mature cottonwoods may be extensive. Reducing current fuel load, either by restoring flooding or by mechanical removal, is needed to lessen the impact of fires on riparian forests along the Rio Grande [80].